Remarks:

Claims 1–42 are pending with claims 1, 14, 23 and 34 being independent. Claims 1–4, 6, 7, 8, 23–26, and 28 were rejected under 35 U.S.C. § 102(b) as being anticipated by Esrig, U.S. Patent No. 4,755,874. Claims 5 and 27 were rejected under 35 U.S.C. § 103(a), as being unpatentable over Esrig in view of Jaber, U.S. Patent No. 5,262,967. Claims 17 and 37 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Esrig in view of Wallack, U.S. Patent No. 6,748,110, Mitsuyama, U.S. Patent No. 5,768,412, and Jaber. Claims 9–11, 14–16, 18–20, 29–31, 34–36, and 38–40 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Esrig in view of Wallack and Mitsuyama. Claims 12, 21, 32, and 41 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Esrig in view of Wallack, Mitsuyama, and Oosawa, U.S. Patent 6,151,408. Finally, claims 13, 22, 33, and 42 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Esrig in view of Wallack, Mitsuyama, and Cho, "Feature Extraction using Fuzzy Relations for Objects of Various Shapes," IEEE Conference on Systems, Man, and Cybernetics, vol. 1, 1996, p. 272–75.

The application invention generally provides an automated system and method for determining characteristics of a sample of concrete or other material based on information gathered using image processing and pattern recognition techniques. The system broadly includes equipment for automatically positioning the sample in a field of view of a microscope, illuminating the sample, and capturing magnified and illuminated images of a surface of the sample for processing. The sample is illuminated at a grazing angle "which accentuates voids and improves surface contrast by producing strong shadows within the voids while brightly illuminating the edges of the voids opposite the light source."

Esrig, in contrast, discloses a system for detecting faults in an integrated circuit chip, referred to as "the device under test" or the "DUT". (Esrig, abstract). More particularly, the system disclosed in Esrig locates a damaged dielectric of an integrated circuit by detecting "extremely faint light" generated by a current flowing through the damaged dielectric. (*Id.*, col. 1, lines 9–11). Such defects are internal to the integrated

circuit, as is well known in the art and evidenced by prior art defect detection techniques involving "stripping layers off of the DUT, which can introduce new defects and is extremely time consuming." (*Id.*, col. 1, line 66–col. 2, line 2).

The method disclosed in Esrig involves first illuminating the DUT with an external light source and capturing a "reflected light top view image" of the DUT. (*Id.*, col. 1, lines 23–26; *see* Fig. 1). The illumination is then removed and a "background image" of the DUT is captured that includes only undesired, random background light. (*Id.*, lines 27–34). Power is then applied to the DUT to energize the integrated circuit therein, and an "emitted light image" of the DUT is captured that includes both the undesired background light as well as emitted light spots corresponding to integrated circuit defects. (*Id.*, lines 39–44). The background image is subtracted from the emitted light image, resulting in a "difference image" that includes only defect emission bright spots. (*Id.*, lines 43–45). Because the difference image is generated in the absence of ambient light, the reflected light top view image is superimposed over the difference image to determine the physical location of each defect emission bright spot on the DUT. (*Id.*, lines 58–62).

Thus, while the application invention determines characteristics of a sample of concrete or other such material by processing a *reflected* light image, the system disclosed in Esrig detects faults in an integrated circuit or other such device by processing an image of *internally generated* light. Esrig employs a reflected light image of the DUT merely to enable a user to approximate a physical location of a fault.

Turning now to the rejection of claim 1 based on 35 U.S.C. § 102(b), claim 1 has been amended to recite a light source that illuminates a sample at a grazing angle "to enhance a contrast between surface features of the sample," and a computing device operable to execute a computer program "to substantially automatically conduct an analysis of the image to identify surface features of the sample and determine characteristics of the sample therefrom." The new language is supported in the specification at page 10, lines 3–30, among other places.

Applicant respectfully asserts that none of the prior art references cited by the Examiner, considered singly or in combination, teach or suggest all of the limitations of amended claim 1. The prior art references do not teach or suggest, for example,

illuminating a sample at a grazing angle "to enhance a contrast between surface features of the sample." The system disclosed in Esrig merely mentions an illumination means (29) without describing the placement or function of the illumination means other than that it is used to illuminate the DUT in order to generate a reflected light top view image of the DUT, as explained above. (*see, e.g.*, Esrig, col. 1, lines 22–26; col. 4, lines 46–47; col. 5, lines 27–29). While Figs. 2, 11 and 12 of Esrig show the illumination device casting light on the DUT, Esrig is utterly devoid of any teaching or suggestion to position the illumination device to cast light at a grazing angle to enhance a contrast between surface features.

Furthermore, Esrig cannot be modified to include casting light from a grazing angle to enhance a contrast between surface features. There is no suggestion or motivation to make such a modification, for example, because it would render the system disclosed in Esrig unsatisfactory for its intended purpose. As noted above, Esrig uses the reflected light image as a map to locate faults in an integrated circuit by superimposing the reflected light image over the processed difference image and matching defect light emissions visible in the difference image to locations on the integrated circuit visible in the reflected image. As explained in Esrig, the processed difference image is "difficult to recognize" (Esrig, col. 1, lines 58–59), and the defects in the difference image are represented by "extremely faint emissions of light" (*Id.*, col. 2, lines 4–5). Thus, attempting to illuminate the DUT from a grazing angle to enhance a contrast between surface features would render the system *more difficult to use* because contrasts between surface features may be mistaken for the "extremely faint emissions of light" present in the difference image that represent faults in the integrated circuit.

Furthermore, the prior art does not teach or suggest a computing device operable to execute a computer program "to substantially automatically conduct an analysis of the image to identify surface features of the sample and determine characteristics of the sample therefrom." Esrig, for example, discloses an image computer (14) that is programmed to differentiate between "noise spots" and "defect bright spots" and to remove the noise spots (Esrig, col. 5, lines 36–57), wherein the defect bright spots result from photo emissions generated by the defects. Thus, while the computer of Esrig is programmed to detect *light emitted from within* an integrated circuit and separate the

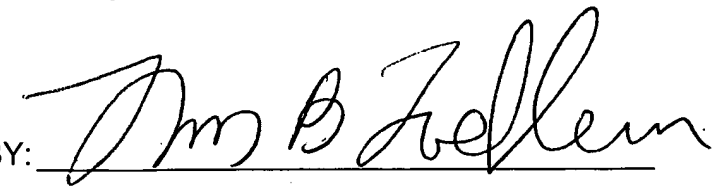
light from noise, the computer of the application invention is programmed to identify *surface features* and *determine characteristics of the sample therefrom.* Finally, modifying the computer of Esrig to identify surface features of the DUT would render it unsatisfactory for its intended purpose because the integrated circuit defects Esrig seeks to detect are located *within* the DUT and therefore would not be detectable by identifying surface features of the integrated circuit.

Thus, the prior art does not teach or suggest all of the limitations of amended claim 1. Claims 14, 23, and 34 have been amended to recite language similar to the new language of amended claim 1, therefore the arguments set forth in relation to amended claim 1 apply to those claims. Furthermore, claims 2–13 depend from claim 1; claims 15–22 depend from claim 14; and claims 35–42 depend from claim 34.

In view of the remarks herein, applicant respectfully submits that claims 1–42 are in allowable condition and requests a Notice of Allowance. In the event of further questions, the Examiner is urged to call the undersigned. Any additional fee which is due in connection with this amendment should be applied against our Deposit Account No. 19-0522.

Respectfully submitted,

HOVEY WILLIAMS LLP

BY: 

Thomas B. Luebbering, Reg. No. 37,874
2405 Grand Blvd., Suite 400
Kansas City, Missouri 64108
(816) 474-9050

ATTORNEYS FOR APPLICANT(S)